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Facsimile Cover Sheet

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Company:	U. S. Patent & Trademark Office	From:	Marcella Wilhite
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Message:

RE: U. S. Patent Application No. 10/799,020
Filed 03-11-2004
Attorney Docket No. 10040086-1

Enclosed are:

1. Response to Notification of Non-Compliant Appeal Brief

Respectfully Submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant: Grot et al.
Serial No.:10/799,020
Filed: March 11, 2004
For: PHOTONIC CRYSTAL SENSORS
Attorney Docket No. 10040086-1

Group Art Unit: 2883
Examiner: James P. Hughes

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF ON APPEAL

Sir:

This brief is in furtherance of Applicant's Notice of Appeal filed July 17, 2006 appealing the decision of the Examiner dated March 15, 2006 finally rejecting Claims 1-24. A copy of the Claims appears in the Appendix to this Brief.

REAL PARTY IN INTEREST

The real party in interest in this appeal is: Agilent Technologies, Inc.

RELATED APPEALS AND INTERFERENCES

With respect to other appeals or interferences that will directly affect, or be directly affected by, or have bearing on the Board's decision in the pending appeal, there are no such appeals or interferences.

STATUS OF CLAIMS

A. TOTAL NUMBER OF CLAIMS IN THE APPLICATION

Claims in the Application are 1-24.

B. STATUS OF ALL CLAIMS IN APPLICATION

1. Claims cancelled: NONE

2. Claims withdrawn from consideration but not cancelled: NONE

3. Claims pending: 1-24

4. Claims allowed: NONE

5. Claims rejected 1-24

C. CLAIMS ON APPEAL

The Claims on Appeal are: 1-24.

STATUS OF AMENDMENTS

A Response to the Final Office Action was filed May 15, 2006, however, no Amendments were made to the Claims. An Advisory Action before Filing of an Appeal Brief was issued June 5, 2006. Therefore, the Claims on appeal herein are Claims 1-24 as finally rejected in the Final Office Action dated May 15, 2006.

SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention is directed to photonic crystal sensors made from two or three dimensional photonic crystal lattice structures by introduction of a lattice defect. Photonic crystal sensors in accordance with the invention are used to measure thin film thicknesses with measurement areas that may be less than 1 μm^2. The photonic crystal sensor is typically coated with a thin conformal film whose thickness is to be measured. Optical fields are typically confined to a radius less than about 600 nm in photonic crystal sensors made from two dimensional photonic crystal lattices. Photonic crystal sensors made from two dimensional photonic crystals may be arranged in arrays to allow the rapid interrogation of a large number of samples.

A two dimensional photonic crystal sensor apparatus in accordance with the invention is described starting on page 4, line 16, shown in FIG. 1. The apparatus, as recited in Claim 1, for a two dimensional photonic crystal sensor (100) comprises a waveguide (175) for inputting light; and a photonic crystal slab (110) optically coupled to the waveguide (175), the photonic crystal slab (110) comprising a two dimensional periodic lattice of holes (115), the two dimensional periodic lattice of holes (115) comprising a lattice constant (a) and a defect hole (118), the photonic crystal slab (110) operable to receive the light from the waveguide (175) and operable to confine the light in the defect hole (118) at an operating wavelength.

A two dimensional photonic crystal sensor apparatus in accordance with the invention is described starting on page 18, line 8, shown in FIGs. 5a-5b. The apparatus as recited in Claim 15, for a two dimensional crystal sensor (500) comprises a photonic

crystal slab (563) comprising a two dimensional periodic lattice of holes (560) with a lattice constant (a) and a plurality of defect holes (525, 535, 545), the photonic crystal slab (563) operable to confine light at a plurality of operating wavelengths to the plurality of defect holes (525, 535, 545); and a substantially straight line of defects (562) defining a waveguide (520) in the two dimensional periodic lattice of holes (560), the waveguide (520) optically coupling to the plurality of defect holes (525, 535, 545).

A two dimensional photonic crystal sensor apparatus in accordance with the invention is described starting on page 20, line 3, shown in FIG. 6a. The apparatus as recited in Claim 18, for a two dimensional crystal sensor comprises a plurality of input waveguides (615); and a photonic crystal slab (600) optically coupled to each of the plurality of waveguides (615), the photonic crystal slab (600) comprising a two dimensional periodic lattice of holes with a lattice constant and a plurality of defect holes (610), the photonic crystal slab (600) operable to receive light from the plurality of waveguides (615) and operable to confine the light at a plurality of operating wavelengths in the plurality of defect holes.

A three dimensional photonic crystal sensor apparatus in accordance with the invention is described starting on page 17, line 1, shown in FIGs. 4a-4b. The apparatus as recited in Claim 22, for a three dimensional photonic crystal sensor (400) comprises an input waveguide (452) and a three dimensional photonic crystal lattice structure (401) optically coupled to the waveguide (452), the three dimensional photonic crystal lattice structure (401) having a defect region (435), the three dimensional photonic crystal lattice structure (401) operable to receive light from the input waveguide (452) and operable to confine the light at an operating wavelength in the defect region (435).

A photonic crystal sensor apparatus is described starting on page 4, line 16 and page 17, line 1 in FIGs. 1, 4a, 4b. The apparatus as recited in Claim 24 for a photonic crystal sensor (100, 400) comprises a waveguide (175, 452) for inputting and a photonic crystal structure (110, 410) optically coupled to the waveguide (175, 452), the photonic crystal structure comprising a lattice (115, 450), the lattice comprising a lattice constant and a lattice defect (118 , 435), the photonic crystal structure (110, 401) operable to receive light from the waveguide (175, 452) and operable to confine the light in the lattice defect (118, 435) at an operating wavelength.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 5, 7. 14, 15 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Sugitatsu et al. (U.S. Publication No. 2004/0062505).

Claims 1, 4, 7, 22 and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by Shirane et al. (U.S. Patent No. 6,937, 781).

Claims 1, 2, 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. (U.S. Publication No. 2004/0027646) in view of Romagnoli et al. (U.S. Publication No. 2005/0175304).

Claims 1 and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soljacic et al. (U.S. Publication No. 2004/0033009) in view of Sugitatsu et al. (U.S. Publication No. 2004/0062505), in further view of Miller et al. (U.S. Publication No. 2004/0027646).

Claims 1, 9-12 and 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Platzman (U.S. Pat. No. 6,697,542).

ARGUMENT

FIRST GROUNDS OF REJECTION

Claims 1, 5, 7. 14, 15 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Sugitatsu et al. (U.S. Publication No. 2004/0062505).

Anticipation requires the presence in a single prior art disclosure of all the elements of a claimed invention arranged as in the claim. *Connell v. Sears, Roebuck & Co.* 722 F.2d at 1548 (Fed. Cir. 1983). Patentable weight is accorded to the preamble: "[i]f the claim preamble, when read in context of the entire claim, recites limitations of the claim, or if the claim preamble is 'necessary to give life, meaning, and vitality ' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, In. v. Hewlett-Packard Co.* 182 F.3d 12978 1305 (Fed. Cir. 1995). The preamble with respect to Claims 1, 5, 7, 14, 15 and 24 clearly is to be read into the Claims as it makes it clear that the claimed invention is a photonic crystal sensor and further defines the structure of the apparatus as a sensor. See *Kropa v. Robie*, 187 F.2d 1329, 1333 (CCPA 1951).

Sugitatsu et al. does not disclose a 2-dimensional photonic crystal sensor apparatus but instead discloses a semiconductor laser oscillator (e,g, see page 4, paragraph 0052) . The Examiner identifies the "sensor (e.g. 10)" and states because ""Sugitatsu teaches an emitter (e.g. 41) connected to a detector (e.g. 61), which in turn is detected to controllers (e.g. 62, 63) that allow control of the device. Thus, as the emitted light is detected and this detection provides a function in the device, the device operates as a sensor". However, Claim 1 of the instant application makes clear that the claimed apparatus is a "photonic crystal sensor" whereas the Examiner attempts to argue that

because in the device of Sugitatsu a detection operation is performed to monitor active optical device, this makes the device of Sugitatsu a photonic crystal sensor. Clearly, this is not the case. The device disclosed by Sugitatsu et al. is a semiconductor laser oscillator having a photodetector and the photodetector (e.g. 61) is not a "photonic crystal sensor" as recited in Claim 1.

Furthermore, it is noted that Claim 1 recites in part that "said photonic crystal slab is operable to receive said light from said waveguide and operable to confine said light in said defect hole at an operating wavelength" (emphasis added) whereas in Sugitatsu et al. "the photodetector 61 detects laser beams radiated from the point (isolated) defect (41)" (emphasis added) (paragraph 0091). In other words, Sugitatsu et al. disclose radiating light from "point defect (41)" and not "confin[ing] said light in said defect hole" as recited in Claim 1.

Therefore, each and every element of Claim 1 is not disclosed by Sugitatsu et al. and Claim 1 is allowable over Sugitatsu et al. Claims 5, 7, 14 depend from Claim 1 and are allowable for at least the same reasons as Claim 1.

Similarly to the remarks for Claim 1, Claim 15 recites "a photonic crystal sensor" and recites "confin[ing] light at a plurality of operating wavelengths to said plurality of defect holes". Therefore, each and every element of Claim 15 is not disclosed by Sugitatsu et al and hence Claim 15 is allowable over Sugitatsu et al.

Similarly to the remarks for Claim 1, Claim 24 recites a "a photonic crystal sensor" and recites "confine said light in said lattice defect". Therefore, each and every element of Claim 24 is not disclosed by Sugitatsu et al and hence Claim 24 is allowable over Sugitatsu et al.

Therefore, Appellant respectfully requests allowance of Claims 1, 5, 7. 14, 15 and 24.

SECOND GROUNDS FOR REJECTION

Claims 1, 4, 7, 22 and 23 are rejected under 35 U.S.C. 102(e) as being anticipated by Shirane et al. (U.S. Patent No. 6,937, 781).

Anticipation requires the presence in a single prior art disclosure of all the elements of a claimed invention arranged as in the claim. *Connell v. Sears, Roebuck & Co.* 722 F.2d at 1548 (Fed. Cir. 1983). Patentable weight is accorded to the preamble: "[i]f the claim preamble, when read in context of the entire claim, recites limitations of the claim, or if the claim preamble is 'necessary to give life, meaning, and vitality ' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, In. v. Hewlett-Packard Co.* 182 F.3d 12978 1305 (Fed. Cir. 1995). The preamble with respect to Claims 1, 4, 7, 22, and 23 clearly is to be read into the Claims as it makes it clear that the claimed invention is a photonic crystal sensor and further defines the structure of the apparatus as a sensor. See *Kropa v. Robie*, 187 F.2d 1329, 1333 (CCPA 1951).

Shirane does not disclose a 2-dimensional "photonic crystal sensor" and does not disclose a "defect hole" as recited in Claim 1. Shirane discloses an optical switch having photonic crystal structure. A switch is not a sensor. Shirane discloses a line-defect which is not a "defect hole" as recited in Claim 1 and nowhere discloses a "sensor" as recited in Claim 1. Hence, Claim 1 is allowable over Shirane and Claims 4 and 7 which depend from Claim 1 are allowable for at least the same reasons as Claim 1. Claim 23 recites in part a "three dimensional photonic crystal sensor". Shirane nowhere discloses a"three

dimensional photonic crystal" nor a "three dimensional photonic crystal sensor". Hence, Claim 22 is allowable over Shirane and Claim 23 which depends from Claim 22 is allowable for at least the same reasons as Claim 22.

Therefore, Appellant respectfully requests allowance of Claims 1, 4, 7, 22 and 23.

THIRD GROUNDS FOR REJECTION

Claims 1, 2, 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. (U.S. Publication No. 2004/0027646) in view of Romagnoli et al. (U.S. Publication No. 2005/0175304).

The Examiner has failed to make a prima facie case of obviousness. To establish a prima facie case of obviousness three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and reasonable expectation of success must be found in the prior art, and not based on the applicant's disclosure. *In Re Vaeck, 947* F.2d 488, (Fed. Cir. 1991).

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, (Fed. Cir. 1990).

In order to rely on a reference as a basis of rejection of an Applicant's invention, the reference must be either in the field of the Applicant's endeavor or, if not, then be

reasonably pertinent to the particular problems with which the inventor was concerned. *In re Oetiker,* 977 F.2d 1443, (Fed. Cir. 1992).

Patentable weight is accorded to the preamble: "[i]f the claim preamble, when read in context of the entire claim, recites limitations of the claim, or if the claim preamble is 'necessary to give life, meaning, and vitality ' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, In. v. Hewlett-Packard Co.* 182 F.3d 12978 1305 (Fed. Cir. 1995).

Miller et al. deals with providing "photonic crystals whose properties can be reversibly tuned or switched and devices for controlling propagation of electromagnetic radiation that incorporate such crystals" (emphasis added) (page 2, paragraph 11). Hence, Miller et al. are concerned with providing "photonic crystals with properties that can be reversibly tuned or switched as well as electromagnetic propagation and routing devices that exploit these crystals" (emphasis added) (page 3, paragraph 23). Romagnoli et al. deals with a method for guiding an electromagnetic radiation, in particular in an integrated optical device. Neither Romagnoli et al. nor Miller et al. teach a "photonic crystal sensor" apparatus as recited in Claim 1 and are non-analogous art. The Examiner has failed to make a prima facie case of obviousness because there is no motivation or suggestion to combine the cited two references because they do not disclose, teach or suggest a "photonic crystal sensor" as recited in Claim 1 and hence, the combination is improper. Additionally, the combination of references does not teach or suggest all the claim limitations such as "confin[ing] said light in said defect hole" as recited in Claim 1. Therefore, Claim 1 is allowable over Miller et al. in view of Romagnoli et al. Claims 2, 3 and 6 depend from Claim 1 and are allowable for at least the same reasons as Claim 1.

Therefore, Appellant respectfully requests allowance of Claims 1, 2, 3 and 6.

FOURTH GROUNDS FOR REJECTION

Claims 1 and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soljacic et al. (U.S. Publication No. 2004/0033009) in view of Sugitatsu et al. (U.S. Publication No. 2004/0062505), in further view of Miller et al. (U.S. Publication No. 2004/0027646).

The Examiner has failed to make a prima facie case of obviousness. To establish a prima facie case of obviousness three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and reasonable expectation of success must be found in the prior art, and not based on the applicant's disclosure. *In Re Vaeck, 947* F.2d 488, (Fed. Cir. 1991).

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, (Fed. Cir. 1990).

In order to rely on a reference as a basis of rejection of an Applicant's invention, the reference must be either in the field of the Applicant's endeavor or, if not, then be reasonably pertinent to the particular problems with which the inventor was concerned. *In re Oetiker,* 977 F.2d 1443, (Fed. Cir. 1992).

Patentable weight is accorded to the preamble: "[i]f the claim preamble, when read in context of the entire claim, recites limitations of the claim, or if the claim preamble is 'necessary to give life, meaning, and vitality ' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, In. v. Hewlett-Packard Co.* 182 F.3d 12978 1305 (Fed. Cir. 1995).

As discussed above in the Third Grounds for Rejection, neither Miller et al. nor Sugitatsu et al . are analogous to a "photonic crystal sensor" apparatus as recited in Claims 1 and 15 as they do not teach or suggest either individually or in combination all the limitations of Claims 1 and 15. The addition of Soljacic et al. which deals with optimal bistable switching in non-linear photonic crystals does nothing to change the argument. The three references are non-analogous art. Hence, the Examiner has failed to make a prima facie case of obviousness because there is no motivation or suggestion to combine the cited three references because they do not disclose, teach or suggest a "photonic crystal sensor" as recited in Claims 1 and 15 and hence, the combination is improper. Additionally, the combination of references does not disclose, teach or suggest all the claim limitations such as "confin[ing] said light in said defect hole" as recited in Claims 1 and 15. Hence, Claims 1 and 15 are allowable over Soljacic et al. in view of Sugitatsu et al., in further view of Miller et al. Claims 13-14 depend from Claim 1 and are allowable for at least the same reasons as Claim 1. Claims 16-17 depend from Claim 15 and are allowable for at least the same reasons as Claim 15.

FIFTH GROUNDS FOR REJECTION

Claims 1, 9-12 and 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Platzman (U.S. Pat. No. 6,697,542).

The Examiner has failed to make a prima facie case of obviousness. To establish a prima facie case of obviousness three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and reasonable expectation of success must be found in the prior art, and not based on the applicant's disclosure. *In Re Vaeck, 947* F.2d 488, (Fed. Cir. 1991).

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, (Fed. Cir. 1990).

In order to rely on a reference as a basis of rejection of an Applicant's invention, the reference must be either in the field of the Applicant's endeavor or, if not, then be reasonably pertinent to the particular problems with which the inventor was concerned. *In re Oetiker*, 977 F.2d 1443, (Fed. Cir. 1992).

Patentable weight is accorded to the preamble: "[i]f the claim preamble, when read in context of the entire claim, recites limitations of the claim, or if the claim preamble is 'necessary to give life, meaning, and vitality ' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, In. v. Hewlett-Packard Co.* 182 F.3d 12978 1305 (Fed. Cir. 1995).

The Examiner has not clearly characterized Platzman et al. Platzman et al. deals with integrated optical switches using nonlinear optical media and there is not a teaching, disclosure or suggestion by Platzman et al. of an apparatus and method comprising a 2 D sensor apparatus. Platzman et al. is non-analogous art. The invention taught, disclosed or suggested by Platzman et al. is an integrated optical switch. The Examiner has not provided any reasoning that would lead one of ordinary skill in the art at the time to modify the integrated optical switch of Platzman et al. to make a "photonic crystal sensor" apparatus as recited in Claims 1 and 18. Hence, there is no motivation to modify Platzman et al. to make a "photonic crystal sensor" as recited in Claims 1 and 18. Additionally, Platzman et al. do not teach or suggest all the claim limitations of Claims 1 and 18. Therefore Claims 1 and 18 are allowable over Platzman et al. Claims 9-12 depend from Claim 1 and are allowable for at least the same reasons as Claim 1. Claims 19-21 depend from Claim 18 and are allowable for at least the same reasons as Claim 18.

Therefore, Appellant respectfully requests allowance of Claims 1, 9-12 and 18-21.

Hence, Claims 1-24 are allowable and it is respectfully requested that the Board of Patent Appeals and Interferences reverse the Examiner's final rejection of Claims 1-24 so that this case may be allowed and pass to issue in a timely manner.

Respectfully submitted,

/J. Krause-Polstorff/

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CLAIMS APPENDIX

1. A two dimensional photonic crystal sensor apparatus comprising:

a waveguide for inputting light; and

a photonic crystal slab optically coupled to said waveguide, said photonic crystal slab comprising a two dimensional periodic lattice of holes, said two dimensional periodic lattice of holes comprising a lattice constant and a defect hole, said photonic crystal slab operable to receive said light from said waveguide and operable to confine said light in said defect hole at an operating wavelength.

2. The apparatus of Claim 1 wherein said defect hole has a larger volume than said holes.

3. The apparatus of Claim 1 wherein said defect hole has a smaller volume than said holes.

4. The apparatus of Claim 1 wherein said photonic crystal slab is comprised of silicon.

5. The apparatus of Claim 1 wherein said two dimensional periodic lattice is a triangular lattice.

6. The apparatus of Claim 1 wherein said defect hole has a substantially elliptical cross-section.

7. The apparatus of Claim 1 wherein said photonic crystal sensor is operable to outcouple light from said photonic crystal slab in a direction perpendicular to said photonic crystal slab.

8. The apparatus of Claim 1 further comprising a tunable optical source coupled to said waveguide.

9. The apparatus of Claim 1 wherein said waveguide is a conventional ridge waveguide.

10. The apparatus of Claim 1 wherein an operating wavelength of said photonic crystal sensor is determined by a dither system.

11. The apparatus of Claim 1 wherein an operating wavelength of said photonic crystal sensor is determined by a synchronized scanning system.

12. The apparatus of Claim 1 wherein an operating wavelength of said photonic crystal sensor is determined by a using system of multiple light emitting diodes.

13. The apparatus of Claim 1 wherein an operating wavelength of said photonic crystal sensor is determined by using a slope based detection system.

14. The apparatus of Claim 1 wherein a photodetector is positioned out of the plane of said photonic crystal slab to be operable to detect said light at an operational wavelength of said photonic crystal sensor.

15. A two dimensional photonic crystal sensor apparatus comprising:
a photonic crystal slab comprising a two dimensional periodic lattice of holes with a lattice constant and a plurality of defect holes, said photonic crystal slab operable to confine light at a plurality of operating wavelengths to said plurality of defect holes; and
a substantially straight line of defects defining a waveguide in said two dimensional periodic lattice of holes, said waveguide optically coupling to said plurality of defect holes.

16. The apparatus of Claim 14 said plurality of defect holes do not all have the same volume.

17. The apparatus of Claim 14 wherein said plurality of defect holes are arranged in an order to maximize the optical coupling of said waveguide to said plurality of defect holes.

18. A two dimensional photonic crystal sensor apparatus comprising:

a plurality of input waveguides; and

a photonic crystal slab optically coupled to each of said plurality of waveguides, said photonic crystal slab comprising a two dimensional periodic lattice of holes with a lattice constant and a plurality of defect holes, said photonic crystal slab operable to receive light from said plurality of waveguides and operable to confine said light at a plurality of operating wavelengths in said plurality of defect holes.

19. (The apparatus of Claim 18 wherein said plurality of input waveguides is optically addressed using a diffractive array generator.

20. The apparatus of Claim 18 wherein said plurality of input waveguides is optically addressed using a dynamically reconfigurable diffractive array generator.

21. The apparatus of Claim 18 wherein said plurality of input waveguides is optically addressed using a MEMs based dynamically reconfigurable mirror array.

22. A three dimensional photonic crystal sensor comprising:

an input waveguide; and

a three dimensional photonic crystal lattice structure optically coupled to said waveguide, said three dimensional photonic crystal lattice structure having a defect region, said three dimensional photonic crystal lattice structure operable to receive light from said input waveguide and operable to confine said light at an operating wavelength in said defect region.

23. The apparatus of Claim 22 further comprising an output waveguide operable for outcoupling said light at said operating wavelength from said three dimensional photonic crystal lattice structure.

24. A photonic crystal sensor apparatus comprising:

a waveguide for inputting; and

a photonic crystal structure optically coupled to said waveguide, said photonic crystal structure comprising a lattice, said lattice comprising a lattice constant and a lattice defect, said photonic crystal structure operable to receive light from said waveguide and operable to confine said light in said lattice defect at an operating wavelength.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.